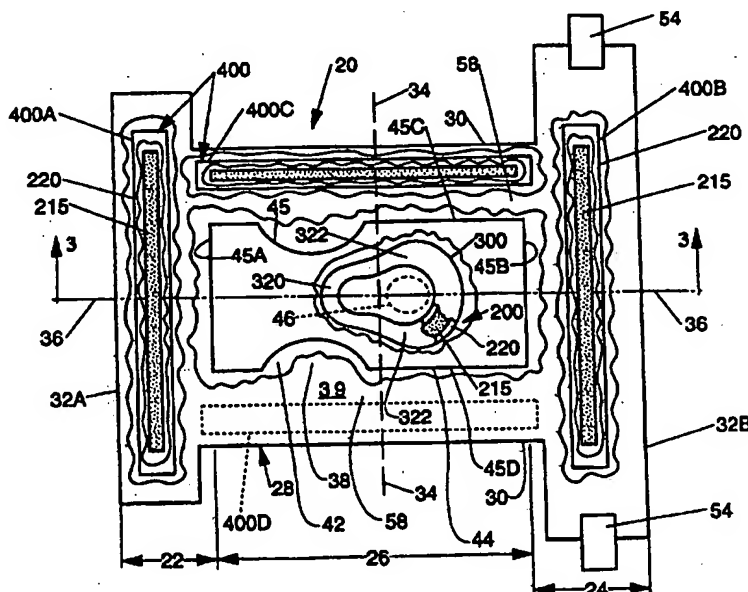




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>A61F 13/15</b>		<b>A1</b>	(11) International Publication Number: <b>WO 95/32698</b>
			(43) International Publication Date: 7 December 1995 (07.12.95)
(21) International Application Number: PCT/US95/05478 (22) International Filing Date: 3 May 1995 (03.05.95) (30) Priority Data: 08/251,801          31 May 1994 (31.05.94)          US (71) Applicant: THE PROCTER & GAMBLE COMPANY [US/US]; One Procter & Gamble Plaza, Cincinnati, OH 45202 (US). (72) Inventors: LaVON, Gary, Dean; 7320 Canterbury Court, Middletown, OH 45044 (US). VINNAGE, William, Robert, Jr.; 5611 Kenwood Road, Cincinnati, OH 45227 (US). HINES, Letha, Margie; 320 East Mills Avenue, Cincinnati, OH 45215 (US). (74) Agents: REED, T., David et al.; The Procter & Gamble Company, 5299 Spring Grove Avenue, Cincinnati, OH 45217 (US).		(81) Designated States: AM, AU, BB, BG, BR, BY, CA, CN, CZ, EE, FI, GE, HU, JP, KG, KP, KR, KZ, LK, LR, LT, LV, MD, MG, MN, MX, NO, NZ, PL, RO, RU, SG, SI, SK, TJ, TT, UA, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ, UG).  Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.	

(54) Title: DISPOSABLE ABSORBENT ARTICLE HAVING A SEALED EXPANDABLE COMPONENT



## (57) Abstract

An absorbent article having an expandable component. The expandable component comprises a compressed, resilient element disposed within an air impermeable envelope. The compressed element provides the absorbent article with a thin, low bulk profile prior to use of the disposable absorbent article, thereby reducing shipping and storage space. At the point of use of the absorbent article, the air impervious envelope is opened, thereby permitting entry of air into the envelope and expansion of the compressed element. In one embodiment the expandable component is a spacer for maintaining fecal void space in a disposable diaper. Alternatively, the expandable component can provide displacement of the topsheet relative to the backsheet along the longitudinal centerline of a sanitary napkin.

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GB	United Kingdom	MR	Mauritania
AU	Australia	GE	Georgia	MW	Malawi
BB	Barbados	GN	Guinea	NE	Niger
BE	Belgium	GR	Greece	NL	Netherlands
BF	Burkina Faso	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
BJ	Benin	IT	Italy	PL	Poland
BR	Brazil	JP	Japan	PT	Portugal
BY	Belarus	KE	Kenya	RO	Romania
CA	Canada	KG	Kyrgyzstan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LU	Luxembourg	TD	Chad
CS	Czechoslovakia	LV	Latvia	TG	Togo
CZ	Czech Republic	MC	Monaco	TJ	Tajikistan
DE	Germany	MD	Republic of Moldova	TT	Trinidad and Tobago
DK	Denmark	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	US	United States of America
FI	Finland	MN	Mongolia	UZ	Uzbekistan
FR	France			VN	Viet Nam
GA	Gabon				

5

## DISPOSABLE ABSORBENT ARTICLE HAVING A SEALED EXPANDABLE COMPONENT

### FIELD OF THE INVENTION

The present invention is related to disposable absorbent articles having a  
10 consumer activated component that is expandable at the point of use of the  
disposable absorbent article.

### BACKGROUND OF THE INVENTION

Disposable absorbent articles are used to absorb and retain body exudates, such  
15 as urine, fecal material, menses, and the like. A particular desired feature of  
disposable absorbent articles is the capability to acquire and hold body exudates to  
minimize leakage of body exudates from between the absorbent article and the  
wearer.

References in the art teach adding a spacer to the disposable absorbent article  
20 for aiding in the containment of fecal material. Such spacers suffer from the  
disadvantage that they increase the initial thickness of the disposable absorbent  
article, and thereby increase shipping and storage costs. Such spacers may also be  
perceived by consumers to be uncomfortable because of their thickness prior to  
application of the diaper to the wearer. Examples of spacers are shown in the  
25 following references: U.S. Patent 5,176,672 issued January 5, 1993 to Bruemmer et  
al., U.S. Patent 5,171,236 issued December 15, 1992 to Dreier et al., and U.S. Patent  
Application Serial No. 07/898,047, Spacers for Use in Disposable Absorbent Articles  
and Disposable Absorbent Articles Having Such Spacers, filed June 11, 1992 by  
Allen et al.

30 Still other references disclose absorbent articles having inflatable structures.  
French Patent Application 2,561,078 published September 20, 1985 in the name of  
Lefebvre discloses a diaper having a structure which is inflatable by mouth. Such  
inflation can be awkward or inconvenient, especially in public areas or when the  
diaper is already fastened to the wearer. Such an arrangement is also  
35 disadvantageous because of sanitary considerations.

U.S. Patents 3,881,491 and 3,921,232 issued to Whyte on May 6, 1975 and  
November 25, 1975 respectively, disclose disposable absorbent articles having self  
inflating structures. The self inflating structures include a wall of semipermeable  
material through which body fluids can pass, and a gas evolving material which  
40 interacts with an activator material (e.g., urine) to inflate the structure. The  
structure taught by Whyte primarily prevents core densification and suffers from the

5 disadvantage that it requires an activator material from an external source, such as urine. The wearer may not urinate at the desired time, in the desired location, or in the desired amount to properly inflate the structure. U.S. Patent Application Serial Nos. 08/081,733 filed June 23, 1993 in the name of Ahr et al. and 08/081,536 filed June 23, 1993 in the name of LaVon et al. disclose inflatable diaper components  
10 whose inflation requires wetting of the component or mixture of two different materials.

Accordingly, it is an object of the present invention to provide a disposable absorbent article having a component that is expandable at the point of use of the absorbent article by a wearer, or by a person caring for the wearer, before or after the  
15 absorbent article is fastened to the wearer.

It is also an object of the present invention to provide a diaper having a spacer for maintaining a fecal void space, wherein the spacer thickness can be increased without the need for wetting of the spacer, and wherein the spacer thickness can be activated at a time selected by the consumer or wearer.

20 It is another object of the present invention to provide a sanitary napkin having a component which is expandable at the point of use of the sanitary napkin to provide separation and lift of the topsheet and core relative to the backsheet of the sanitary napkin, and increased caliper of the sanitary napkin along the longitudinal centerline of the sanitary napkin.

25 It is a further object of the present invention to provide an absorbent article having an expandable component comprising a compressed resilient element disposed in an air impermeable envelope.

#### SUMMARY OF THE INVENTION

30 The invention comprises a disposable absorbent article having a topsheet, a backsheet, an absorbent core disposed intermediate the topsheet and backsheet, and an expandable component disposed on the absorbent article. The expandable component comprises a resilient element compressed within an envelope. The resilient element expands upon opening the envelope, or removing a portion of the  
35 envelope. In a preferred embodiment, the expandable component comprises a compressed resilient element disposed within an air impermeable envelope. The air impermeable envelope can be evacuated, such as by vacuum sealing, to have an internal pressure less than the outside atmospheric pressure. The expandable component expands from a first thickness to a second thickness greater than the first  
40 thickness upon opening of the air impermeable envelope.

5       The air impermeable envelope can comprise a port having a releasable closure. The releasable closure can be removed at the point of use of the disposable absorbent article to permit air to enter the envelope through the port, thereby providing expansion of the expandable component. In one embodiment, the releasable closure can be resealable, so that air drawn into the port does not escape when the  
10       expandable component is subjected to compressive loading.

      The resilient element can be porous, so that when the releasable closure is removed from the port, expansion of the resilient element draws air into the resilient element, as well as into the space in the envelope not occupied by the resilient element. In one such embodiment, the resilient element can comprise an open celled  
15       polymeric foam.

      The expandable component can be positioned on the body facing surface of the topsheet, on the garment facing surface of the backsheet, or between the topsheet and the backsheet. In one embodiment the expandable component is disposed intermediate the backsheet and the absorbent core. The expandable component can  
20       comprise a spacer for maintaining a fecal void space in a disposable diaper. Alternatively, the expandable component can provide a seal in the waist regions or the side margins of a disposable diaper. In another embodiment the expandable component is located along the longitudinal centerline of a sanitary napkin to provide lifting of the topsheet and core relative to the backsheet, and increased caliper of the  
25       sanitary napkin along the longitudinal centerline of the sanitary napkin.

#### BRIEF DESCRIPTION OF THE DRAWINGS

      Figure 1 is a top plan view of a disposable diaper with portions of the topsheet and absorbent core shown cutaway to illustrate expandable components, including a keyhole shaped spacer for maintaining a fecal void space, and  
30       seals positioned in the waist regions and side margins of the diaper.

      Figure 2 is a top plan view of a disposable diaper similar to that of Figure 1, with portions of the topsheet and absorbent core shown cutaway to illustrate an expandable component comprising a U-shaped spacer opening rearward, and with expandable components shown (in phantom)  
35       positioned to provide seals in the side margins, including seals on leg cuffs.

      Figure 3 is an sectional view taken along line 3-3 in Figure 1 showing the expandable components in a compressed configuration.

40       Figure 4 is an sectional view similar to that of Figure 3 showing the expandable components in an expanded configuration.

- 5 Figure 5 is an enlarged view of a portion of the port in the air impermeable envelope, and the releasable closure for covering the port.
- Figure 6 is a sectional view taken along lines 6-6 in Figure 2 showing expandable components disposed in the side margin of the diaper, including an expandable component disposed on a leg cuff.
- 10 Figure 7 is a frontal view of an individually wrapped and folded sanitary napkin.
- Figure 8 is a top view of the individually wrapped sanitary napkin of Figure 7, shown unfolded, and having an expandable component (shown in phantom) extending along the longitudinal centerline of the sanitary napkin.
- 15 Figure 9 is a sectional view taken along lines 9-9 of Figure 8 showing the expandable component in a compressed configuration.
- Figure 10 is a sectional view similar to that of figure 9 showing the expandable component in an expanded configuration.
- 20 Figure 11 is a schematic illustration of a method for forming an expandable component according to the present invention.

### DETAILED DESCRIPTION OF THE INVENTION

As used herein, the term "absorbent article" refers to devices which absorb and contain body exudates, and, more specifically, refers to devices which are placed against or in proximity to the body of the wearer to absorb and contain the various exudates discharged from the body. Such absorbent articles include, but are not limited to, diapers, training pants, incontinence briefs, diaper holders, diaper liners, and feminine hygiene products such as sanitary napkins, pantliners, and the like. The term "disposable" is used herein to describe absorbent articles which are not intended to be laundered or otherwise restored or reused as an absorbent article (i.e., they are intended to be discarded after a single use and, preferably, to be recycled, composted or otherwise disposed of in an environmentally compatible manner).

30

One embodiment of an absorbent article of the present invention is the unitary disposable diaper 20, shown in Figure 1. As used herein, the term "diaper" refers to an absorbent article generally worn by infants and incontinent persons that is worn about the lower torso of the wearer. Figure 1 is a plan view of the diaper 20 of the present invention in its flat-out, uncontracted state (i.e., with elastic induced contraction pulled out) with portions of the structure being cutaway to more clearly show the construction of the diaper 20 and with the portion of the diaper 20 which faces or contacts the wearer, the inner surface, oriented towards the viewer. The

40

5     diaper 20 is shown in Figure 1 to have a front waist region 22, a rear waist region 24, a crotch region 26, and a periphery 28 comprising longitudinal edges 30 and front and rear lateral end edges 32A and 32B. The diaper 20 also has a lateral centerline 34 and a longitudinal centerline 36.

10     As used herein, the "longitudinal" dimension, direction, or axis of the diaper 20 is aligned front to back with respect to the wearer as the disposable absorbent article is worn. The "lateral" or "transverse" dimension, direction, or axis of the diaper 20 is orthogonal the longitudinal direction and is sideways aligned as the diaper 20 is worn. The "Z-direction" is orthogonal to both the longitudinal and transverse directions, and is illustrated in Figure 3.

15     The front waist region 22 and the rear waist region 24 are those portions of the diaper 20 which, when worn, encircle the waist of the wearer and are generally the highest elevation of the diaper 20 when the wearer is in the standing position. The crotch region 26 is disposed between the front and rear waist regions 22, 24 and is that part of the diaper 20 which, when worn, is between the wearer's legs.

20     As shown in Figures 1-3, the diaper 20 comprises a liquid pervious topsheet 38, a liquid impervious backsheet 42, the backsheet 42 joined at least peripherally with the topsheet 38, and an absorbent core 44 disposed intermediate the topsheet 38 and the backsheet 42. The absorbent core 44 can comprise one or more layers, with one layer shown in the Figures. The absorbent core 44 has a perimeter 45 which  
25 includes front and rear laterally extending ends 45A and 45B, as well as side edges 45C and 45D. The absorbent core 44 does not extend longitudinally into the front and rear waist regions 22, 24, but terminates in the crotch region 26 at front and rear laterally extending ends 45A and 45B. The diaper 20 has side margins 58 extending laterally from the absorbent core side edges 45C and 45D to the longitudinal edges  
30 of the diaper 20. The side margins 58 include those portions of the topsheet 38 and/or backsheet 42 which extend laterally outward from the absorbent core side edges 45C and 45D.

35     The diaper 20 has a body facing surface 39 comprising that portion of the diaper 20 which is positioned adjacent to the wearer's body during use (i.e., the surface 39 generally is formed by at least a portion of the topsheet 38.) The diaper also has a garment facing surface 43 (Figure 3) comprising that portion of the diaper 20 which is positioned away from the wearer's body (i.e., the garment facing 43 generally is formed by at least a portion of the backsheet 42, and can comprise other components joined to the backsheet 42.)

40     The diaper 20 according to the present invention also comprises at least one component 200 expandable from a compressed configuration having a first thickness

5 T1 shown in Figure 3, to an expanded configuration having a second thickness T2 greater than T1, as shown in Figure 4. In the compressed configuration, the expandable component 200 comprises a compressed resilient element 215 disposed within an air impermeable envelope 220. The air impermeable envelope 220 can also comprise a port 222 having a releasable closure 250.

10 Without being limited by theory, it is believed that the compressed resilient element 215 does not expand within the sealed air impermeable envelope 220 because such expansion would increase the volume within the sealed air impermeable envelope 220, and thereby lower the air pressure within the sealed envelope 220. Accordingly, the relatively constant atmospheric pressure outside the sealed envelope  
15 220 prevents expansion of the resilient element 215 within the sealed air impermeable envelope 220. Upon opening the air impermeable envelope 220, such as by releasing the closure 250 to permit air to enter the envelope 220 through the port 222, the expandable component 200 is expandable from the first thickness T1 in the compressed configuration shown in Figure 3 to have a predetermined shape and a  
20 second thickness T2 (Figure 4) greater than T1. The second thickness T2 is preferably at least about twice the thickness T1.

By the term "compressed" it is meant that the element 215 has a reduced thickness within the sealed air impermeable envelope 220 which is less than the free, unrestrained thickness of the element 215. The reduced thickness of the resilient  
25 element 215 within the sealed envelope 220 is preferably no more than about one half the free, unrestrained thickness of the element 215. By "resilient" it is meant that the element 215 can be compressed (such as by a Z-direction compressive loading) from its free, unrestrained thickness to its reduced thickness, and that upon release of force maintaining the element 215 in a compressed configuration, the element 215 expands  
30 to have a thickness which is at least 70 percent, and preferably at least 85 percent of its free, unrestrained thickness within about 10 minutes.

The diaper 20 can also include a pair of fasteners 54, such as tape tabs or mechanical fasteners, positioned in the rear waist region 24 for fastening the diaper  
35 20 to the wearer. The diaper can also have a waist elastic feature (not shown), gasket cuffs (not shown), and barrier leg cuffs 60 (Figures 2 and 6) having a proximal edge 62 joined to a side margin 58 of the diaper 20, and distal edge 64 spaced from the topsheet 38. U.S. Patent 3,848,594 issued November 19, 1974 to Buell and U.S.  
40 Reissue Patent B1 4,662,875 reissued May 5, 1987 to Hirotsu et al. are incorporate herein by reference to illustrate suitable tape tab fasteners 54. U.S. Patent 3,860,003 issued January 14, 1975 to Buell; U.S. Patent 4,081,301 issued March 28, 1978 to Buell; U.S. Patent 4,695,278 issued September 22, 1987 to Lawson; and U.S. Patent



5 4,938,755 issued July 3, 1990 to Foreman are incorporated herein by reference to illustrate gasket cuffs and barrier leg cuffs 60. U.S. Patent 4,515,595 issued May 17, 1985 to Kievit; and U.S. Patent 4,816,025 issued March 28, 1989 to Foreman are incorporated herein by reference to illustrate an elasticized waistband for a diaper 20.

10 In one embodiment, the expandable component 200 can comprise a spacer 300 disposed intermediate the topsheet 38 and the backsheet 42, as shown in Figures 1-4, for maintaining a Z-direction fecal void space 311 (Figure 4). In the embodiment shown, the spacer 300 is disposed intermediate the absorbent core 44 and the backsheet 42. In another embodiment, the expandable component 200 can comprise seals, such as seals 400A and 400B for preventing leakage of body exudates from the  
15 front and rear waist regions 22 and 24, respectively, and seals 400C and 400D for preventing leakage of body exudates from the side margins 58. In yet another embodiment, the expandable component 200 can comprise seals 400E disposed on barrier leg cuffs 60, as shown in phantom in Figure 2, and as shown in cross-section in Figure 6.

20 Referring to the components of the diaper 20 in more detail, Figure 1 shows an embodiment of the diaper 20 in which the topsheet 38 and the backsheet 42 have length and width dimensions generally larger than those of the absorbent core 44. The topsheet 38 and the backsheet 42 extend longitudinally beyond the laterally extending core ends 45A and 45B to form the front and rear waist regions 22 and 24.  
25 The topsheet 38 and backsheet 42 extend laterally beyond core side edges 45C and 45D to form side margins 58. While the topsheet 38, the backsheet 42, and the absorbent core 44 may be assembled in a variety of well known configurations, preferred diaper configurations are described generally in U.S. Patent 3,860,003 issued to Buell on January 14, 1975 and U.S. Patent 5,151,092 issued to Buell on  
30 September 29, 1992, each of which is incorporated herein by reference.

The spacer 300 illustrated in Figure 1 has a generally "keyhole" shape comprising a closed figure. Other suitable closed shapes for the spacer 300 include, but are not limited to, circles, squares, and elongated shapes, such as ovals and rectangles. Alternatively, the spacer 300 can comprise an open figure, such as the  
35 generally U-shaped figure opening rearward shown in Figure 2. The spacer 300 preferably includes a laterally extending portion 320 joining two longitudinally extending portions 322. Suitable shapes and dimensions for a spacer 300 are disclosed in U.S. Patent Application Serial No. 08/081,536 filed June 23, 1993 in the name of LaVon et al.; U.S. Patent Application Serial No. 08/081,733, filed June 23,  
40 1993 in the name of Ahr et al.; U.S. Patent Application Serial No. 07/898,047, filed June 11, 1992 in the name of Allen et al.; and U.S. Patent 5,171,236 issued

5 December 15, 1992 to Dreier et al., which documents are incorporated herein by reference.

In embodiments where the expandable component 200 comprises a fecal void volume spacer 300, the topsheet 38 and the absorbent core 44 can comprise apertures 46 and 47 respectively (the aperture 46 is shown in phantom in Figure 1).  
10 The apertures 46 and 47 can be registered with one another, as shown in Figure 4, to provide a passageway for the communication of fecal material from the wearer's anal opening into the void space 311.

As used herein, a "void space" is a cavity intermediate the topsheet 38 and the backsheet 42, which cavity is sized to accept fecal material. The void space  
15 preferably has a Z-direction height of at least about 0.65 centimeters (0.25 inch) and a volume of at least about 16.4 cubic centimeters (1.0 cubic inch). The volume of the void space 311 can be reduced if the absorbent core 44 is compressed between the topsheet 38 and the backsheet 42 by the wearer's weight. When expanded to the have the second thickness T2, the spacer 300 helps to maintain the volume of the  
20 void space 311 for receiving fecal matter.

The topsheet 38 and backsheet 42 are generally coextensive and at least partially peripherally joined together. As used herein the term "joined" refers to the condition where a first member or component is affixed or connected to a second member or component, either directly, or indirectly where the first member or  
25 component is affixed or connected to an intermediate member or component, which in turn is affixed or connected to the second member or component.

The topsheet 38 and backsheet 42 may be joined by any means well known in the art, such as adhesive bonding, heat sealing, ultrasonic bonding, or the like. Suitable adhesives for joining the topsheet 38 and backsheet 42 include Century 5227  
30 adhesive manufactured by Century Adhesives, Inc. of Columbus, Ohio; HL1258 adhesive sold by the H. B. Fuller Company of St. Paul, Minnesota; or Findley H2031 hot melt adhesive manufactured by the Findley Adhesive Company of Elmgrove, Wisconsin. The adhesive can be applied in beads, bands, or spirals.

As used herein, the term "absorbent core " refers to any component of the  
35 diaper 20 used for absorbing and retaining body exudates. The absorbent core 44 may have opposed major faces and may, if desired, be encased by one or more layers of tissue (not shown). The absorbent core 44 may be made from a variety of commonly used materials such as comminuted wood pulp, typically referred to as airfelt. If desired, the absorbent core 44 may further contain absorbent gelling  
40 materials as is commonly used in the art. In particular, the absorbent core 44 may be made in accordance with the teachings of U.S. Patent 4,610,678 issued September 9,

5 1986 to Weisman et al.; U.S. Patent 4,673,402 issued to Weisman et al. on June 16, 1987; U.S. Patent 4,834,735 issued May 30, 1989 to Alemany et al.; U.S. Patent 5,147,345 issued September 15, 1992 to Young et al.; U.S. Patent 5,217,445 issued June 8, 1993 to Cook et al.; and U.S. Patent 5,234,423 issued August 10, 1993 to Alemany et al., which patents are incorporated herein by reference for the purpose of  
10 showing how to make an absorbent core 44 suitable for use with the present invention. Absorbent gelling materials made in accordance with commonly assigned U.S. Patent Re. 32,649 issued April 19, 1988 to Brandt et al. are suitable for use in a diaper 20 according to the present invention.

The core 44 can be joined to the underside of the topsheet 38, as shown in  
15 Figure 3. Alternatively, the core 44 can be joined to the backsheet 42, or the core 44 can comprise two or more layers. The absorbent core 44 may be adhesively joined to the topsheet 38 or backsheet 42 by any attachment means well known in the art. Suitable attachment means include but are not limited to adhesive beads and longitudinal and transverse bands or spirals of adhesive. Suitable adhesives for  
20 joining the core 44 to other components of the diaper 20 include XPO-9-035 adhesive manufactured by the Minnesota Mining and Manufacturing Company of St. Paul, Minnesota, as well as the Century 5227, the Fuller HL1258, and the Findley H2031 adhesives listed above.

Referring back to Figure 1, the "topsheet" refers to any liquid pervious facing  
25 of the diaper 20 which contacts the skin of the wearer while the diaper 20 is worn and prevents substantial contact of the absorbent core 44 with the skin of the wearer. The topsheet 38 is preferably compliant, tactilely pleasant and non-irritating to the skin of the wearer. The topsheet 38 can be treated to be hydrophilic, to more readily transport body exudates to the absorbent core 44.

30 A suitable topsheet 38 may be manufactured from materials such as porous foams, apertured plastic films, natural fibers (e.g., wood fibers or cotton fibers), synthetic fibers (e.g., polyester or polypropylene fibers) or a combination of the foregoing. A particularly preferred topsheet 38 comprises polypropylene fibers having a denier of about 2.2 and a length of about 15.9 millimeters (0.62 inches).  
35 The topsheet 38 may be manufactured according to a number of techniques. For example, the topsheet 38 may be a nonwoven web of fibers spunbonded, carded, wet-laid, meltblown, hydroentangled, combinations of the above, or the like. One suitable topsheet 38 is carded and thermally bonded and has a basis weight of about 18 to about 25 grams per square meter. A suitable topsheet 38 is manufactured by  
40 the Veratec, Inc. Division of International Paper Company of Walpole, Massachusetts under the designation P-8.

5       The apertures 46 and 47 can be laterally centered on the longitudinal axis 36. The aperture 46 may be of any shape desired with a suitable shape being an oval having a longitudinal dimension, in one embodiment, of at least about 5.1 centimeters (2.0 inches) and a transverse dimension of at least about 3.8 centimeters (1.5 inches). The rearwardmost edge of the aperture 46 can be disposed at least about 15.2  
10   centimeters (6.0 inches) from the rear edge 32B of the diaper 20 while it is worn. In one embodiment the rearwardmost edge of the aperture 46 is between about 17.8 centimeters (7.0 inches) and about 21.6 centimeters (8.5 inches) from the rear edge 32B of the diaper 20 while it is worn. Of course, the location and size of the aperture 46 may be varied to accommodate different size wearers.

15       Aperture 47 is registered with aperture 46, and can have a shape the same as, or similar to, the shape of aperture 46. Preferably, the spacer 300 is registered with the apertures 46 and 47, such that spacer 300 does not substantially obstruct aperture 46 or aperture 47, and such that at least a portion of each aperture 46 and 47 is disposed intermediate the longitudinally extending portions 322 of spacer 300.  
20   Alternatively, the spacer 300 can be joined to the body facing surface 39 of the topsheet 38.

      The backsheet 42 is impervious to fluids, such as urine, and prevents fluids absorbed by and contained in the absorbent core 44 from wetting undergarments, clothing and bedding. As used herein the term "backsheet" refers to any barrier  
25   disposed outwardly of the absorbent core 44 as the diaper 20 is worn and which contains absorbed liquids within the diaper 20. The backsheet 42 is preferably manufactured from a thin thermoplastic film, although other flexible liquid impervious materials may also be used. As used herein, the term "flexible" refers to materials which are compliant and will readily conform to the general shape and  
30   contours of the human body.

      The backsheet 42 may comprise a woven or nonwoven material, polymeric films such as thermoplastic films of polyethylene or polypropylene, or composite materials such as film-coated nonwoven material. The backsheet 42 can be a thermoplastic film having a thickness of from about 0.01 millimeters to about 0.051  
35   millimeters (0.0004 to 0.002 inches). If desired, the backsheet 42 may be embossed or matte finished to provide a clothlike appearance. A suitable material from which the backsheet 42 can be formed is a polyethylene film having a thickness of from about 0.010 mm to about 0.051 mm. Suitable polyethylene films are manufactured by Clopay Corp. of Cincinnati, Ohio under the designation P-18-1401, and by  
40   Tredegar Industries of Terre Haute, Indiana under the designations X8297 and HTS-

5 5, FSII. Other suitable materials from which the backsheet 42 can be formed include RR8220 blown films and RR5475 cast films manufactured by Tredegar Industries.

Alternatively, one or both of the topsheet 38 and the backsheet 42 can be extensible, being formed of an elastomeric or stretchable film. Extensible components are described in International Patent Publication WO 93/01785,  
10 "Stretchable Absorbent Articles" published February 4, 1993, which document is incorporated herein by reference. For example, the backsheet 42 or portions of the backsheet 42 may comprise a structural elastic-like film (SELF) web. A structural elastic-like film web is an extensible material that exhibits an elastic-like behavior in the direction of elongation without the use of added elastic materials. The SELF  
15 web includes a strainable network having at least two contiguous, distinct, and dissimilar regions. One of the regions is configured so that it will exhibit resistive forces in response to an applied axial elongation in a direction parallel to the predetermined axis before a substantial portion of the other region develops significant resistive forces to the applied elongation. At least one of the regions has  
20 a surface-path length which is greater than that of the other region as measured substantially parallel to the predetermined axis while the material is in an untensioned condition. The region exhibiting the longer surface-path length includes one or more deformations which extend beyond the plane of the other region. The SELF web exhibits at least two significantly different stages of controlled resistive  
25 force to elongation along at least one predetermined axis when subjected to an applied elongation in a direction parallel to the predetermined axis. The SELF web exhibits first resistive forces to the applied elongation until the elongation of the web is sufficient to cause a substantial portion of the region having the longer surface-path length to enter the plane of applied elongation, whereupon the SELF web  
30 exhibits second resistive forces to further elongation. The total resistive forces to elongation are higher than the first resistive forces to elongation provided by the first region. SELF webs suitable for the present invention are more completely described in the copending, commonly assigned U.S. Patent Application Serial Number 08/203,456 entitled "Absorbent Article with Multiple Zone Structural Elastic-Like  
35 Film Web Extensible Waist Feature" filed by Donald C. Roe, et al. on February 24, 1994 which is incorporated herein by reference.

Referring to Figures 3 and 4, the expandable component 200 comprises a gas impermeable envelope 220 enclosing the compressed resilient element 215. The envelope 220 can be formed by positioning the resilient element 215 between two  
40 envelope walls 232 and 234, compressing the resilient element 215 between the walls

- 5 232 and 234, and joining the flexible envelope walls 232 and 234 to leave a cavity 236 therebetween for holding the resilient element 215.

The flexible walls 232 and 234 can be formed from two separate pieces of material, or alternatively, can be formed from a single piece of folded material. In Figures 3 and 4, the envelope 220 is integral with the backsheet 42, with the wall 234  
10 comprising a portion of the backsheet 42, and with the wall 232 joined directly to a surface of the backsheet 42. Alternatively, the wall 234 can be formed from a piece of material separate from the backsheet 42, and the expandable component 200 can be joined directly to the backsheet 42 by fastening the wall 234 to a surface of the backsheet 42.

- 15 The walls 232 and 234 of the envelope 220 are gas impermeable, and are preferably made from a material which is soft and flexible. Suitable materials from which the walls 232 and 234 can be made include thermoplastic films, metallic foils, and laminates thereof. For instance, a suitable film is a polyethylene film having a thickness of from about 0.010 mm to about 0.051 mm. Suitable polyethylene films  
20 are manufactured by Clopay Corp. of Cincinnati, Ohio under the designation P-18-1401, and by Tredegar Industries of Terre Haute, Indiana under the designations X8297 and HTS-5, FSII. Other suitable materials from which the walls 232 and 234 can be formed include RR8220 blown films and RR5475 cast films manufactured by Tredegar Industries. Another suitable material from which one or both of the walls  
25 232 and 234 can be made is a polyethylene film available from Tredegar Industries designated C-8323.

- With the resilient element 215 positioned between the walls 232 and 234, the walls 232 and 234 can be pressed together by a compressive force to compress the element 215, and while the element 215 is compressed, the walls 232 and 234 are  
30 joined at seams by any suitable joining method such as heat/pressure sealing, adhesive bonding, ultrasonic bonding, or the like, to prevent inflow of air to the cavity 236 upon release of the compressive force. Suitable seams can be formed by using Findley H2031 hot melt adhesive to join the perimeter of the wall 232 to the wall 234, which can comprise part of the backsheet 42. In one embodiment, the air  
35 between the walls 232 and 234 can be evacuated as the walls 232 and 234 are joined together, such as with vacuum sealing equipment known in the art, so that the pressure within the sealed envelope 220 is less than the surrounding outside atmospheric pressure.

- In one embodiment, one or both of the walls 232 and 234 can be formed from  
40 an elastomeric or stretchable film to be extensible in order to accommodate expansion of the resilient element 215 once the envelope 220 is opened. For

5 instance, one or both of the walls 232 and 234 can comprise a SELF web described in the copending, commonly assigned U.S. Patent Application Serial Number 08/203,456 entitled "Absorbent Article with Multiple Zone Structural Elastic-Like Film Web Extensible Waist Feature" filed by Donald C. Roe, et al. on February 24, 1994, which application is incorporated herein by reference.

10 Alternatively, one or both of the walls 232 and 234 can be pre-formed, such as by vacuum forming, embossing, or folding, to accommodate expansion of the resilient element 215. For instance, one or both of the walls 232 and 234 can have pleats for accommodating the expansion of the resilient element 215. In Figure 3, the wall 232 is shown having longitudinally extending pleats 235. In yet another embodiment, the

15 walls 232 and 234 can accommodate the expansion of the resilient element 215 if the unbonded portions of each of the walls 232 and 234 bounding the cavity 236 are sized to have a larger footprint than that of the resilient element 215, as described below.

Figure 11 is a schematic illustration of one apparatus for forming an expandable

20 component 200. The walls 232, 234 and the resilient element 215 are shown positioned intermediate two pieces of plexiglas 1001. The resilient element 215 has a width  $W1$ , and a free, unrestrained thickness  $H1$  prior to compression between walls 232 and 234. Portions of an adhesive layer 239 are spaced apart on wall 234 to leave portions of the walls 232 and 234 unbonded. The spacing  $W2$  between portions of

25 the adhesive layer 239 can be sized so that the unbonded portions of the walls 232 and 234 bounding the cavity 236 have a larger footprint than that of the resilient element 215. The walls 232 and 234 can thereby accommodate expansion of resilient element 215. For instance, the spacing  $W2$  can be sized to be greater than or equal to the sum  $W1 + H1$  to accommodate expansion of the resilient element 215 to a

30 thickness of about  $H1$  upon opening of the envelope 220. Alternatively, the spacing  $W2$  can be made smaller to restrict expansion of the resilient element 215 upon opening the envelope 220. A compressive loading 1000 presses the two walls 232 and 234 together. A conformable piece 1005 can be positioned between one of the pieces of plexiglas 1001 and the wall 232. The conformable piece 1005 aids in

35 distributing the compressive load 1000 across the surface of the wall 232, removing air from between the walls 232 and 234, and reducing wrinkling of the wall 232 as the wall 232 is adhesively joined to the wall 234. The stiffness of the conformable piece 1005 in compression should be less than or about equal to the stiffness of the resilient element 215 in compression. The conformable piece 1005 can be formed

40 from the same material from which resilient element 215 is formed, and can have a thickness greater than or equal to the thickness  $H1$  of the resilient element 215.

5 Referring to Figure 5, the gas impermeable envelope 220 can comprise a port 222 in one of the walls 232, 234, and a releasable closure 250 covering the port. The releasable closure 250 can comprise a piece of film 251 joined to the wall through which the port 222 extends. The film 251 can be formed from the same material from which the walls 232 and 234 are formed, and can be joined to the envelope 220  
10 by any suitable method, including but not limited to adhesive bonding, mechanical bonding, ultrasonic bonding, heat sealing, and the like. The film can be partially or completely peeled from the envelope 220 to expose the port 222, thereby permitting air to enter the cavity 236 for providing expansion of resilient element 215 within the cavity 236. The size of the port 222 can be varied to vary the rate at which the  
15 resilient element 215 expands once the releasable closure 250 is opened. In general, the resilient element 215 will expand more rapidly as the size of the port 222 is increased.

The film 251 can have adhesive 252 for adhering the film 251 to the wall through which the port 222 extends. The adhesive 252 can also permit the closure  
20 250 to be resealed, to thereby cover the port 222 and prevent the escape of air drawn into the cavity 236 by expansion of the resilient element 215. Suitable pressure sensitive adhesives for use with the releasable closure 250 include Century Adhesive A-305-IV manufactured by the century adhesives Corporation of Columbus, Ohio; Adhesive Number 34-2823 manufactured by the National Starch and Chemical  
25 Company of Bridgewater, New Jersey; and Fuller adhesive numbers HL-2238-XZP and HL-2254-XZP manufactured by the H. B. Fuller Company of Vadnais Heights, Minnesota. In an alternative embodiment, a first material can surround the port 222, and the releasable closure 250 can include a second material which is cohesive with the first material. In another embodiment, the closure 250 can comprise a piece of  
30 cellophane tape, such as Scotch Brand Model 600 transparent tape manufactured by the 3M company of Minneapolis, Minnesota.

In another alternative embodiment, the envelope 220 can be formed without a port 222. The closure 250 can include a relatively low tack adhesive 252, and a relatively high tack adhesive 254, as shown in Figure 5. Upon peeling the closure  
35 250 from the envelope 220, the high tack adhesive 254 tears the envelope wall and creates an opening in the envelope 220 through which air can enter. In yet another embodiment, the port 222 and the releasable closure 250 can be omitted, and the air impermeable envelope 220 can be opened by tearing the walls 232 and 234 apart manually, by cutting the envelope 220 with a pair of scissors, or by piercing the  
40 envelope 220 with a lancet.



5       The resilient compressed element 215 is preferably porous, so that when the releasable closure 250 is removed from the port 222, expansion of the resilient element 215 draws air into the resilient element 215, as well as into the space in the cavity 236 not occupied by the resilient element 215. In one such embodiment, the resilient element can comprise a porous sponge. In another embodiment, the resilient  
10    element 215 can comprise an open celled foam, such as an open celled polymeric foam. By open celled it is meant that the individual cells of the foam are for the most part not completely isolated from each other by the polymeric material of the cell walls. Open celled foams, as used herein, can include foams which are initially closed celled, and which are reticulated, such as by compression, to form an open celled  
15    structure within the envelope 220.

One suitable porous foam from which the resilient element 215 can be made is polyurethane foam, such as is available as #1230 foam from the American Excelsior Corp. of Cincinnati, Ohio. Another suitable porous, open celled foam is a foam prepared by polymerizing a high internal phase emulsion, such as is described in U.S.  
20    Patent 5,147,345; High Efficiency Absorbent Articles for Incontinence Management, issued September 15, 1992 in the name of Young et al., which patent is incorporated herein by reference. The pore volume of the resilient element 215 can be at least about 2 ml/gram, and in one embodiment is between about 2 to about 100 ml/gram prior to compression in the envelope 220, as measured in the above referenced U.S.  
25    Patent 5,147,345. The pore volume is a measure of the volume of the open cells in the porous foam structure per unit mass of the solid material which forms the foam structure. Pore volume influences the flexibility and the compression deflection characteristics of the resilient element 215. For a given material, as pore volume increases, flexibility increases and resistance to compression generally decreases. In  
30    addition, as pore volume increases, the amount of air per unit weight of the resilient element 215 which can be drawn into the envelope 220 as the resilient element 215 expands also increases. Accordingly, increased Z-direction thickness can be obtained with a relatively small amount and weight of material.

The resilient element 215 can have a cell size of at least about 5 microns prior  
35    to compression in the envelope 220, as measured in U.S. Patent 5,147,345. For a given material, the rate at which the resilient element 215 expands will generally increase as the cell size of the resilient element 215 increases.

The resilient element 215 can have a density prior to compression in envelope 220 of less than about 1.0 gram per cubic centimeter, and in one embodiment has a  
40    density between about 0.01 to about 0.50 gram per cubic centimeter, as measured in the above referenced U.S. Patent 5,147, 345. The density of the resilient element

5 215 also influences the flexibility and compression deflection characteristics of the resilient element. In general, for a given material, as the density of the resilient element 215 decreases, the flexibility increases and the resistance to compression decreases.

10 By way of example, a spacer 300 was formed using layers of a porous open celled foam having a density of about 0.03 gm/cc, a pore volume of about 32 ml/gram, and a cell size of between about 50 and about 75 microns. The foam was made according to the teachings of above referenced U.S. Patent 5,147,345, with a monomer composition similar to that provided in Example 6 of U.S. Patent 5,147,345. The resilient element 215 comprised seven layers of the porous open  
15 celled foam, each layer having a closed shape enclosing an open area, and each layer having a shape generally the same as the shape of the other layers. Each layer had a width W1 (Figure 11) of about 12.7 mm (0.5 inch) as measured around the perimeter of the closed shape, and a surface area of about 30 square centimeters, with each layer enclosing an open area of about 30 square centimeters. Each layer of foam had  
20 a free, unrestrained thickness of about 0.070 inch, so that the resilient element 215 had a total Z-direction thickness H1 of about 0.49 inch prior to compression. Findley H2031 adhesive was applied to one side of a first sheet of polyethylene, the sheet of polyethylene having a thickness of about 0.0010 inch (0.025 mm). The adhesive was applied to the sheet of polyethylene so as to leave an adhesive free area having a  
25 closed shape. The adhesive free area was sized to have a projected area larger than that of the layers forming the resilient element 215, to thereby accommodate expansion of the resilient element 215. The width W2 (Figure 11) of the adhesive free area at any point around the perimeter of the adhesive free area was about 2.54 centimeters (1.0 inch), or about equal to the height H1 plus the width W1. A port  
30 222 having a diameter of about 0.5 inch was cut in the first sheet of polyethylene, and covered with a piece of Scotch Brand Model 600 Transparent Tape on the side of the first sheet of polyethylene to which adhesive was not applied.

The seven layers of foam were then placed between the first sheet of polyethylene and a second sheet of polyethylene. The seven layers of foam where  
35 compressed by pressing the two sheets of polyethylene and the seven layers of foam together between two pieces of plexiglas, as shown in Figure 11. The compressive loading was about 28 psi. While maintaining the compressive loading, the edges of the first and second sheets of polyethylene were pressed together to adhesively join the sheets around the perimeter of the spacer to provide an air impermeable envelope  
40 220.

5       The caliper of the spacer, including the thickness of both sheets of polyethylene and the seven layers of compressed foam was about 0.150 inch. The piece of Transparent Tape was then removed from the port 222, and the Z-direction caliper of the spacer was measured at predetermined time intervals. The Z-direction caliper was measured using a dial indicator, and was measured under a confining pressure of  
 10       about 0.24 psi with the confining pressure applied to the spacer with a load foot having a 1.0 square inch surface area. The spacer had the following Z-direction calipers at the following times after removing the tape from the port in the first polyethylene sheet:

15	TIME AFTER OPENING	CALIPER
	0 seconds	0.150 inch
	5 seconds	0.175 inch
	10 seconds	0.190 inch
	30 seconds	0.255 inch
20	45 seconds	0.290 inch
	2 minutes	0.402 inch
	5 minutes	0.460 inch

Referring to Figures 1-4 and 6, the expandable component 200 can also  
 25       comprise a seal 400 for reducing leakage of body exudates from between the absorbent article and the wearer's skin. Such seals 400 can include waist region seals 400A and 400B positioned in the front and rear waist regions 22 and 24, respectively, and side margin seals 400C and 400D positioned in the side margins 58. Each of the seals 400 comprises a compressed resilient element 215 disposed within  
 30       an air impermeable envelope 220. The waist region seals 400A, B can each have a generally laterally extending resilient element 215, and the side margin seals 400C, D can each have a generally longitudinally extending resilient element 215. The resilient elements 215 can be disposed intermediate the top sheet 38 and the backsheet 42, as shown in Figures 3 and 4. Referring to Figures 3, 4, and 6, the seals 400 expand  
 35       from a first thickness to a second thickness greater than the first thickness upon opening the envelope 220 enclosing the resilient element 215.

Referring to Figures 2 and 6, the diaper 20 can also include side margin seals 400E, wherein each side margin seal 400E is associated with a barrier leg cuff 60. Each barrier leg cuff 60 extends generally longitudinally along a side margin 58 of the  
 40       diaper 20. Each leg cuff 60 has proximal edge 62 joined to an underlying portion of the diaper 20 in the side margin 58, and distal edge 64 spaced from the proximal edge

- 5 62. The distal edge 64 can include a spacing element 67, such as an elastic element, for spacing the distal edge 64 from the body facing surface 39 of the topsheet 38.

The barrier cuff 60 according to the present invention includes a resilient element 215 disposed within an air impermeable envelope 220. The air impermeable envelope 220 can comprise a first flexible wall 232 and a second flexible wall 234.

10 Each of the walls 232 and 234 can comprise a plastic film, such as a polyethylene film. The walls 232 and 234 can be joined together along the lengths of the proximal and distal edges 62 and 64, as well as at the ends of the barrier leg cuffs positioned in the front and rear waist regions 22 and 24. In the embodiment shown in Figure 6, the wall 232 is joined to the topsheet 38 at the proximal edge 62. The wall 232 can

15 be joined to the topsheet 38 by any suitable means, including but not limited to adhesive, ultra-sonic, mechanical, or heat bonding. The wall 234 is folded to form a hem for containing the spacing element 67, and is joined to the wall 232 along the distal edge 64.

The wall 234 can include a port 222 covered by a releasable closure 250.

20 Upon release of the closure 250, the resilient element 215 expands from a compressed configuration. Expansion of the resilient element 215 provides a seal between the diaper 20 and the wearer's skin. Expansion of the resilient element 215 also helps to space the distal edge 64 from the topsheet 38, and thereby forms a channel 69 intermediate the barrier leg cuff 60 and the topsheet 38. The channel 69

25 holds liquid and solid body exudates which could otherwise leak from between the side margin 58 and the wearer's skin. Figure 6 shows a barrier cuff 60 having both a spacing element 67 and an expandable seal 400E. Alternatively, the spacing element 67 could be omitted. In embodiments where the spacing element 67 is omitted, the seal 400E can be positioned at the distal edge 64 of the barrier cuff 60.

30 Figures 7-10 illustrates a sanitary napkin 720 according to the present invention. Figures 7 and 8 show an individually packaged sanitary napkin 720 packaged in a flexible wrapper 860. The flexible wrapper 860 has an interior surface 861 and an exterior surface 863. The sanitary napkin 720 is joined to the interior surface 861 and folded as a unit with the flexible wrapper 860 along two spaced

35 apart fold lines 852 and 853. The fold lines 852 and 853 divide the flexible wrapper 860 into three panels 862, 864, and 866. The wrapper 860 and the sanitary napkin 720 are shown in a closed, folded configuration in Figure 7, and in a fully unfolded configuration in Figure 8.

The wrapper 860 protects the sanitary napkin 20 from becoming soiled prior to

40 use. The flexible wrapper 860 can be formed from various materials including but not limited to paper, thermoplastic films, metallic foils, or laminates thereof. A

5 suitable material from which the flexible wrapper 860 can be formed comprises a polyethylene film having a thickness of about 0.025 millimeter (about 1 mil). The folded wrapper 860 can be sealed along package edges 870, such as by thermally or adhesively bonding two or more of the panels 862-866 together. A flap edge 868 of the panel 862 can be joined to underlying panel 866 by a piece of tape 869.

10 The sanitary napkin 720 has a longitudinal centerline 736 and a lateral centerline 734. The sanitary napkin 720 comprises a liquid pervious topsheet 738 having a body facing surface 739, a liquid impervious backsheet 742 joined with the topsheet 738 and having a garment facing surface 743, and an absorbent core 744 positioned intermediate the topsheet 738 and the backsheet 742.

15 The sanitary napkin 720 further comprises an expandable component 200 (shown in phantom in Figure 8). The expandable component 200 includes a compressed resilient element 215 disposed in a gas impermeable envelope 220, as shown in Figures 9 and 10. The expandable component 200 expands from a compressed configuration having a first Z-direction thickness T3, to an expanded  
20 configuration having a second Z-direction thickness T4 greater than the first thickness T3, upon opening of the air impermeable envelope 220. The second thickness T4 is preferably at least about twice the first thickness T3. The expandable component 200 thereby locally increases the Z-direction caliper of the sanitary napkin 720. The compressed and expanded configurations are shown in Figures 9 and 10,  
25 respectively. In the expanded configuration, the expandable component 200 provides conformance of a portion of the sanitary napkin 720 with the wearer's body to enhance acquisition of body exudates and reduce soiling of the wearer's undergarment.

While the topsheet 738, backsheet 742, and absorbent core 744 may be  
30 assembled in a variety of well known configurations, suitable configurations are described generally in U.S. Patent 5,007,906 issued April 16, 1991 to Osborn et al.; U.S. Patent 4,950,264 issued to Osborn on August 21, 1990; U.S. Patent 4,425,130 issued to DesMarais on January 10, 1984; U.S. Patent 4,321,924 issued to Ahr on March 30, 1982; and U.S. Patent 4,589,876 issued to Van Tilburg on  
35 August 18, 1987. Each of these patents is incorporated by reference for the purpose of generally describing the assembly of the components of a sanitary napkin 720.

The topsheet 738 is liquid pervious permitting liquids to readily penetrate through its thickness. A suitable topsheet 738 may be manufactured from a wide range of materials such as woven and nonwoven materials, polymeric materials such  
40 as apertured formed thermoplastic films; and thermoplastic scrims. A suitable topsheet 738 comprises an apertured formed film. Suitable formed films are

5 described in U.S. Patent 3,929,135 issued to Thompson on December 30, 1975; U.S. Patent 4,324,246 issued to Mullane et al. on April 13, 1982; U.S. Patent 4,342,314 issued to Radel et al. on August 3, 1982; U.S. Patent 4,463,045 issued to Ahr on July 31, 1984; and U.S. Patent 5,006,394 issued to Baird on April 9, 1991. Each of these patents is incorporated herein by reference. A suitable formed film topsheet  
10 738 is marketed on sanitary napkins by The Procter and Gamble Company of Cincinnati, Ohio as DRI-WEAVE. The body facing surface 739 of the topsheet 738 can be hydrophilic to enhance transfer of body fluids through the topsheet 738. A surfactant can be incorporated into the polymeric materials of the formed film topsheet, or alternatively, the body facing surface 739 of the topsheet can be treated  
15 with a surfactant as described in above referenced U.S. Patent 4,950,254 to Osborn.

The backsheet 742 is impervious to liquids and can be manufactured from a thin plastic film, although other flexible liquid impervious materials may be used. A suitable backsheet 742 is made from a polyethylene film having a thickness of from about 0.010 mm to about 0.051 mm. Suitable films from which the backsheet 742  
20 can be formed are manufactured by Clopay Corporation of Cincinnati, Ohio under the designation P18-0401 and by Ethyl Corporation, Visqueen Division, of Terre Haute, Indiana under the designation XP-39385.

Alternatively, one or both of the topsheet 738 and the backsheet 742 can be extensible, being formed of an elastomeric or stretchable film. For example, the  
25 backsheet 742 or portions of the backsheet 742 may comprise a structural elastic-like film (SELF)-web described above. SELF webs suitable for the present invention are more completely described in the copending, commonly assigned U.S. Patent Application Serial Number 08/203,456 entitled "Absorbent Article with Multiple Zone Structural Elastic-Like Film Web Extensible Waist Feature" filed by Donald  
30 C. Roe, et al. on February 24, 1994 which is incorporated herein by reference.

The absorbent core 744 can be any absorbent means which is capable of absorbing or retaining liquids (e.g., menses and/or urine). The absorbent core may be manufactured in a wide variety of sizes and shapes (e.g., rectangular, oval, hourglass, etc.) and from a wide variety of liquid-absorbent materials such as comminuted wood  
35 pulp, which is generally referred to as airfelt. Other suitable absorbent materials include creped cellulose wadding; meltblown polymers; chemically stiffened, modified, or cross-linked cellulosic fibers; tissue including tissue wraps and tissue laminates; absorbent foams; absorbent sponges; superabsorbent polymers; absorbent gelling materials, and combinations of the above. Suitable absorbent structures for  
40 use as the absorbent core 744 of the present invention are described in U.S. Patent 5,007,906 issued April 16, 1991 to Osborn; U.S. Patent 4,950,264 issued August 21,

5 1990 to Osborn; U.S. Patent 4,610,678 issued September 9, 1986 to Weisman et al.; U.S. patent 4,834,735 issued May 30, 1989 to Alemany et al.; and European Patent Application No. 0 198 683 published October 22, 1986 in the name of Duenk, et al. Each of these patents is incorporated herein by reference for the purpose of showing suitable constructions and materials for the absorbent core 744.

10 The sanitary napkin 720 can also include a pair of laterally extending flaps 752. The flaps 752 are configured to drape over the edges of the wearer's panty in the crotch region so that the flaps 752 are disposed between the edges of the wearer's panty and the thighs. The flaps 752 help prevent soiling of the wearer's body and  
15 panties by body exudates. The flaps 752 can have flap adhesive 754 for fastening the flap 752 to the wearer's panty to thereby keep the sanitary napkin 720 properly positioned in the panty. A piece of flap release paper 753 engages the flap adhesive 754 on each flap 752 to hold the flaps 752 in a folded position overlying the topsheet 738 while the sanitary napkin 720 is folded inside the wrapper 860. The flaps 752 can be unfolded (as shown in phantom in Figure 8) once the release paper 753 is  
20 peeled from the adhesive 754. The following U.S. Patents are incorporated herein by reference for the purpose of showing sanitary napkin constructions having flaps 752: U.S. Patent 4,950,264 issued August 21, 1990 to Osborn; U.S. Patent 4,589,876 issued May 20, 1986 to Van Tilburg; U.S. Patent 4,608,047 issued August 26, 1986 to Mattingly; U.S. Patent 4,687,478 issued August 18, 1987 to Van Tilburg; and  
25 U.S. Patent 5,007,906 issued April 16, 1991 to Osborn et al. The flaps 752 are omitted in Figures 9 and 10 for clarity.

The sanitary napkin 720 can also include garment attachment adhesive 760 (Figure 8) for joining the garment facing surface 743 of the backsheet 742 to the  
30 wearer's panties. A strip of wrapper release paper 900 covers the garment attachment adhesive 760 until the wearer is ready to fasten the sanitary napkin to the wearer's undergarment. The strip of release paper 900 has a first surface 902 and an oppositely facing surface 904. The first surface 902 is joined to the garment facing surface 743 of the backsheet 742 by the garment attachment adhesive 760, and the  
35 second surface 904 of the release paper 900 is joined to the interior surface 861 of the flexible wrapper 860 by wrapper adhesive (not shown). The first surface 902 is preferably treated, such as with a coating comprising silicon, so that the adhesive bond between the surface 902 and the backsheet 742 has a lower strength than the adhesive bond between the surface 904 and the flexible wrapper 860. Such a difference is desirable so that the release paper 900 stays joined to the wrapper 860  
40 when the consumer separates the sanitary napkin 720 from the wrapper 860. The garment attachment adhesive 760 can comprise a pressure sensitive adhesive.

5 Suitable adhesives include Century Adhesive A-305-IV manufactured by the century  
adhesives Corporation of Columbus, Ohio; Adhesive Number 34-2823 manufactured  
by the National Starch and Chemical Company of Bridgewater, New Jersey; and  
Fuller adhesive numbers HL-2238-XZP and HL-2254-XZP manufactured by the H.  
B. Fuller Company of Vadnais Heights, Minnesota. Suitable release paper 900 is  
10 described in U.S. Patent 4,917,697, which patent is incorporated by reference.  
Suitable release paper 900 is manufactured by Akrosil Corporation of Menasha,  
Wisconsin as BL30MG-A Silox E1/O and BL30MG-A Silox 4P/O.

Referring to Figures 9 and 10, the expandable component 200 comprises a  
compressed resilient element 215 enclosed in a gas impermeable envelope 220 having  
15 two envelope walls 232 and 234. In Figures 9 and 10, the envelope 220 is integral  
with the backsheet 742, with the wall 234 comprising a portion of the backsheet 742,  
and with the wall 232 joined directly to a surface of the backsheet 742. Alternatively,  
the wall 234 can be formed from a piece of material separate from the backsheet 742.

The walls 232 and 234 of the envelope 220 are gas impermeable, and are  
20 preferably made from a material which is soft and flexible. Suitable materials from  
which the walls 232 and 234 can be made include thermoplastic films. For instance,  
a suitable film is a polyethylene film having a thickness of from about 0.010 mm to  
about 0.051 mm. Suitable polyethylene films are manufactured by Clopay Corp. of  
Cincinnati, Ohio under the designation P-18-1401, and by Tredegar Industries of  
25 Terre Haute, Indiana under the designations X8297 and HTS-5, FSII. Other suitable  
materials from which the walls 232 and 234 can be formed include RR8220 blown  
films and RR5475 cast films manufactured by Tredegar Industries.

In one embodiment, one or both of the walls 232 and 234 can be formed from  
an elastomeric or stretchable film to accommodate expansion of the resilient element  
30 215. For instance, one or both of the walls 232 and 234 can comprise a SELF web  
described in the copending, commonly assigned U.S. Patent Application Serial  
Number 08/203,456 entitled "Absorbent Article with Multiple Zone Structural  
Elastic-Like Film Web Extensible Waist Feature" filed by Donald C. Roe, et al. on  
February 24, 1994, which application is incorporated herein by reference.  
35 Alternatively, one or both of the walls 232 and 234 can be pre-formed, such as by  
vacuum forming, embossing, or folding, to accommodate expansion of the resilient  
element 215. For instance, one or both of the walls 232 and 234 can have pleats for  
accommodating the expansion of the resilient element 215. In Figure 9, the wall 232  
is shown having longitudinally extending pleats 235.

40 Referring to Figures 9 and 10, the gas impermeable envelope can comprise a  
port 222 in the portion of the backsheet 742 to which the wrapper release paper 900



5 is adhesively joined. As shown in Figure 9, the release paper 900 covers the port 222, and prevents air from entering the cavity 236 between the wall 232 and the wall 234. The release paper 900 and the garment attachment adhesive 760 form a releasable closure for covering the port 222. When the consumer removes the flexible wrapper 860 from the sanitary napkin 720, the release paper 900 remains  
10 adhered to the wrapper 860. The port 222 is thereby uncovered, permitting expansion of the compressed resilient element 215 within the cavity 236, as shown in Figure 10. In alternate embodiments, the envelope 220 can comprise a resealable releasable closure covering the port 222. In yet another embodiment, the port 222 can be omitted, and the air impermeable envelope 220 can be opened by tearing the  
15 walls 232 and 234 apart manually, by cutting the envelope 220 with a pair of scissors, or by piercing the envelope 220 with a lancet.

The resilient compressed element 215 is preferably porous, so that when the releasable closure 250 is removed from the port 222, expansion of the resilient element 215 draws air into the resilient element 215, as well as into the space in the  
20 cavity 236 not occupied by the resilient element 215. In one such embodiment, the resilient element can comprise a porous sponge. In another embodiment, the resilient element 215 can comprise an open celled foam, such as an open celled polymeric foam. One suitable porous foam from which the resilient element 215 can be made is polyurethane foam, such as is available as #1230 foam from the American Excelsior  
25 Corp. of Cincinnati, Ohio. Another suitable porous, open celled foam is a foam prepared by polymerizing a high internal phase emulsion, such as is described in above referenced U.S. Patent 5,147,345; High Efficiency Absorbent Articles for Incontinence Management, issued September 15, 1992 in the name of Young et al.

The expandable component 200 can be disposed intermediate the backsheet  
30 742 and the topsheet 738. In Figures 9 and 10 the compressed resilient element 215 is positioned intermediate the backsheet 742 and the absorbent core 744. The compressed resilient element 215 thereby provides displacement of a portion of the topsheet 738 and the absorbent core 744 relative to the backsheet 742 for enhanced acquisition of body exudates. The compressed resilient element 215 can extend  
35 along the longitudinal centerline 736, as shown in phantom in Figure 8. The resilient element 215 thereby convexly shapes a portion of the body facing surface 739 along the longitudinal centerline 736, and increases the Z-direction thickness of the sanitary napkin 720 along the longitudinal centerline to help conform the topsheet 738 to the wearer's body, particularly in the labial, perianal, and gluteal groove areas. In one  
40 embodiment the resilient element 215 can have a lateral width of between about 1.0 to about 2.0 centimeters and a free, unrestrained Z-direction thickness of between

5 about 1.0 and about 2.0 centimeters prior to compression. In another embodiment, the Z-direction thickness of the resilient element 215 can vary along the longitudinal centerline 736, thereby providing variations in displacement of the topsheet 738 and core 744 along the length of the sanitary napkin 720 for selective fit in the labial, perianal, and gluteal groove areas of the body.

10 Only one longitudinally extending resilient element 215 is shown in Figures 8-10. In other embodiments, the sanitary napkin can include multiple resilient elements 215. The resilient elements 215 can be disposed in separate or interconnected air impermeable envelopes 220. In the embodiment shown in Figures 9-10, the resilient element 215 is disposed intermediate the backsheet 742 and the  
15 topsheet 738. In yet another embodiment, the expandable component can be joined to the garment facing surface 743 of the sanitary napkin 720 to displace the sanitary napkin 720 from the wearer's undergarment.

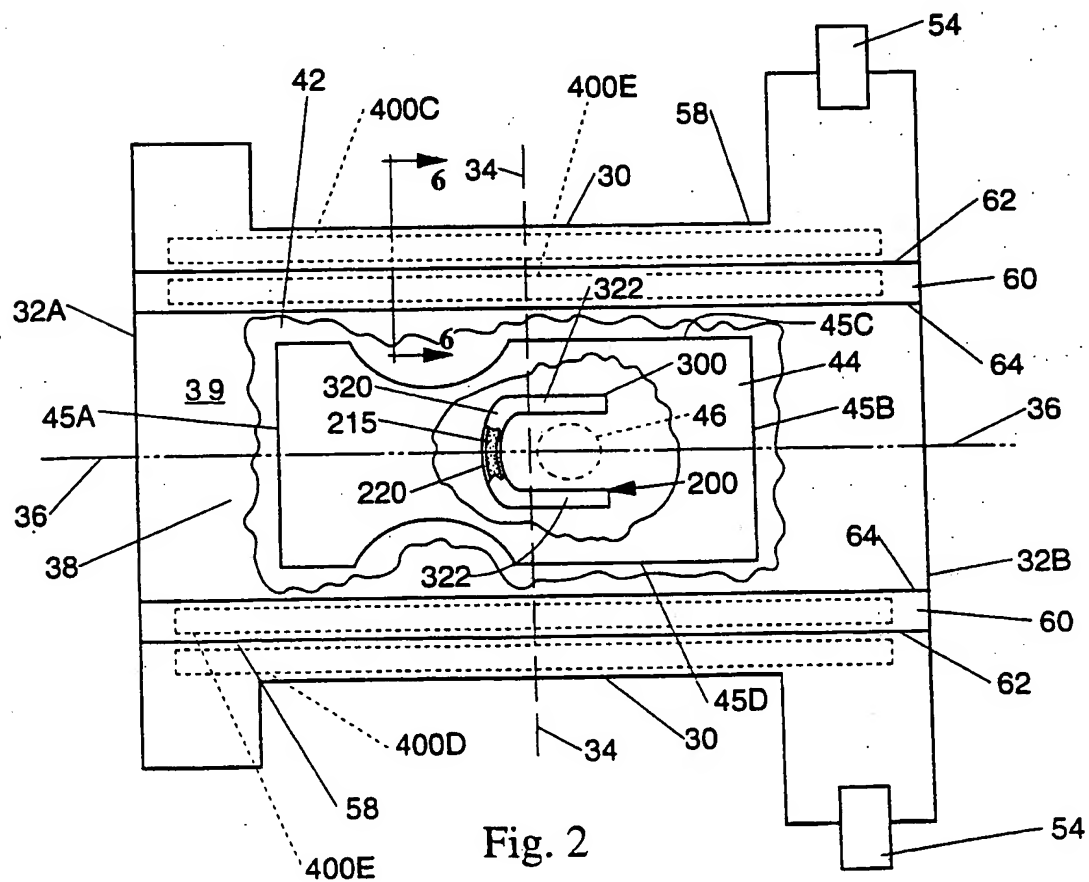
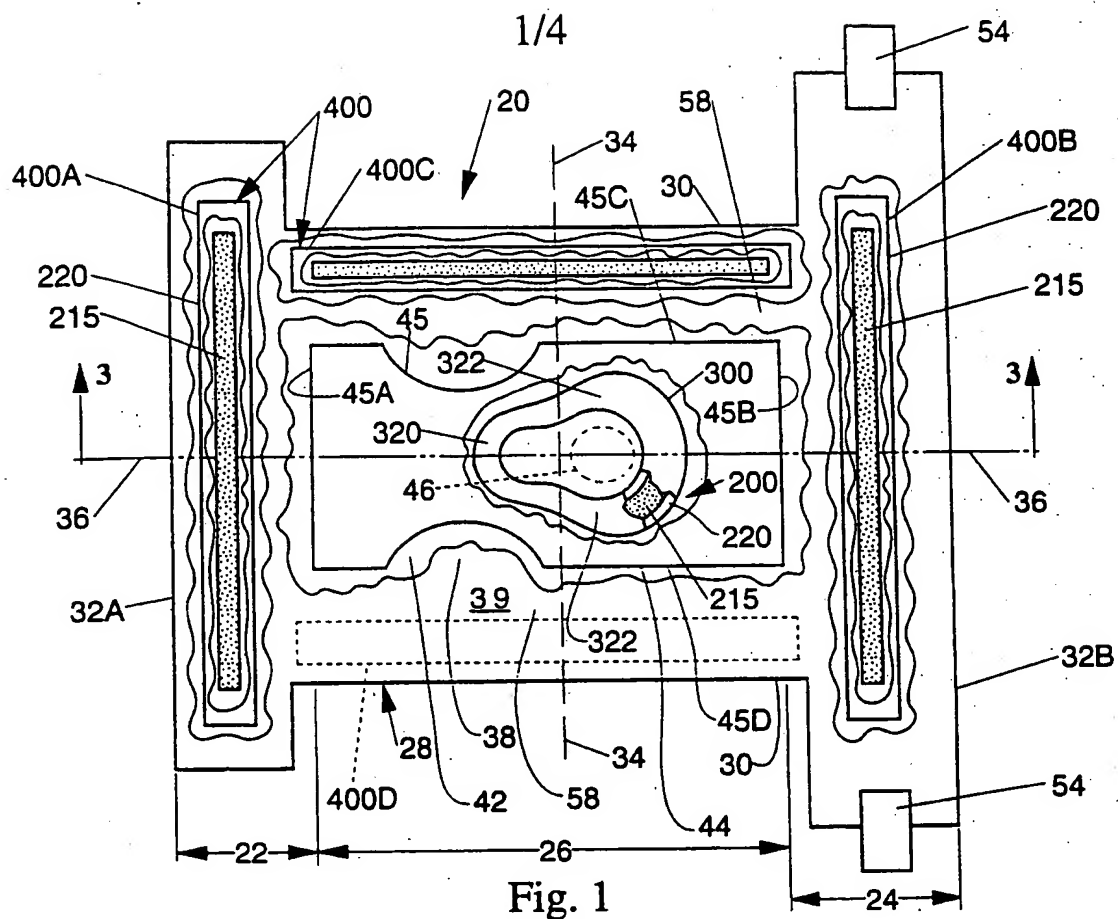
In the embodiments described above, the resilient element 215 is disposed within an air impermeable envelope. In still another embodiment, the resilient  
20 element 215 can be held in a compressed configuration by an envelope which is either air permeable or air impermeable. For example, one or both of the walls 232 and 234 can be air permeable, with the adhesive spacing W2 (Figure 11) sized so that the walls 232 and 234 restrict expansion of the resilient element 215. The resilient element 215 can be expanded at the point of use of the disposable absorbent article  
25 by removing a portion of the envelope holding the resilient element 215 in a compressed configuration. For example, the resilient element 215 can be expanded by removing the wall 232 from the wall 234, such as by tearing or peeling. Referring to Figure 8, in yet another embodiment, the envelope holding the resilient element 215 in a compressed configuration can comprise the wrapper 860. The resilient  
30 element 215 can be compressed as the sanitary napkin 720 and the wrapper 860 are folded as a unit about fold lines 852 and 853. The wrapper 860 is then sealed along edges 870 to maintain compression of the resilient element 215 within the folded and sealed wrapper 860. The resilient element 215 can then expand when the wrapper 860 is opened and removed from the sanitary napkin 720.

35 While particular embodiments of the present invention have been illustrated and described, the scope of the present invention is defined by the appended claims.

What is Claimed is:

1. A disposable absorbent article comprising:  
a backsheet;  
a liquid pervious topsheet joined to the backsheet;  
an absorbent core disposed intermediate the topsheet and the backsheet; and  
an expandable component disposed on the absorbent article, the expandable component comprising a resilient element compressed within an envelope, the expandable component expandable from a first thickness to a second thickness greater than the first thickness upon removing a portion of the envelope.
2. The disposable absorbent article of Claim 1 characterized in that the expandable component comprises a compressed resilient element disposed within an air impermeable envelope, the expandable component expandable from a first thickness to a second thickness greater than the first thickness upon opening of the air impermeable envelope.
3. The disposable absorbent article of Claims 1 and 2 characterized in that the resilient element is porous.
4. The disposable absorbent article of Claims 1, 2, and 3 characterized in that the resilient element comprises an open celled foam.
5. The disposable absorbent article of Claims 1, 2, 3, and 4 characterized in that the second thickness is at least about twice the first thickness.
6. The disposable absorbent article of Claims 2, 3, 4, and 5 characterized in that the air impermeable envelope comprises a port having a releasable closure.
7. The disposable absorbent article of Claim 6 characterized in that the port closure is resealable.
8. The disposable absorbent article of Claims 1, 2, 3, 4, 5, 6, and 7 characterized in that the resilient element is disposed intermediate the topsheet and the backsheet.

9. The disposable absorbent article of Claim 8 characterized in that the resilient element is disposed intermediate the backsheet and the absorbent core.
10. The disposable absorbent article of Claims 1, 2, 3, 4, 5, 6, 7, 8, and 9 characterized in that the disposable absorbent article comprises a disposable diaper, and characterized in that the expandable component comprises a spacer disposed intermediate the topsheet and the backsheet for maintaining a Z-direction fecal void space.
11. The disposable absorbent article of Claims 1, 2, 3, 4, 5, 6, 7, 8, and 9 characterized in that the expandable component comprises at least a portion of a seal for reducing the leakage of body exudates from between the disposable absorbent article and the wearer's skin.
12. The disposable absorbent article of Claim 11 further comprising a leg cuff, and characterized in that the leg cuff comprises an expandable component.
13. The disposable absorbent article of Claims 1, 2, 3, 4, 5, 6, 7, 8, and 9 characterized in that the disposable absorbent article comprises a sanitary napkin having a front edge, a rear edge, longitudinal edges, and longitudinal and lateral centerlines.
14. The sanitary napkin of Claim 13 characterized in that the compressed resilient element has a longitudinally extending portion aligned with the longitudinal centerline of the sanitary napkin.





3/4

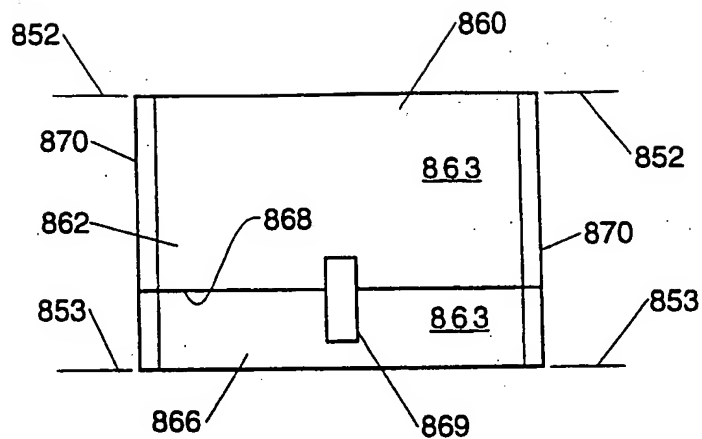


Fig. 7

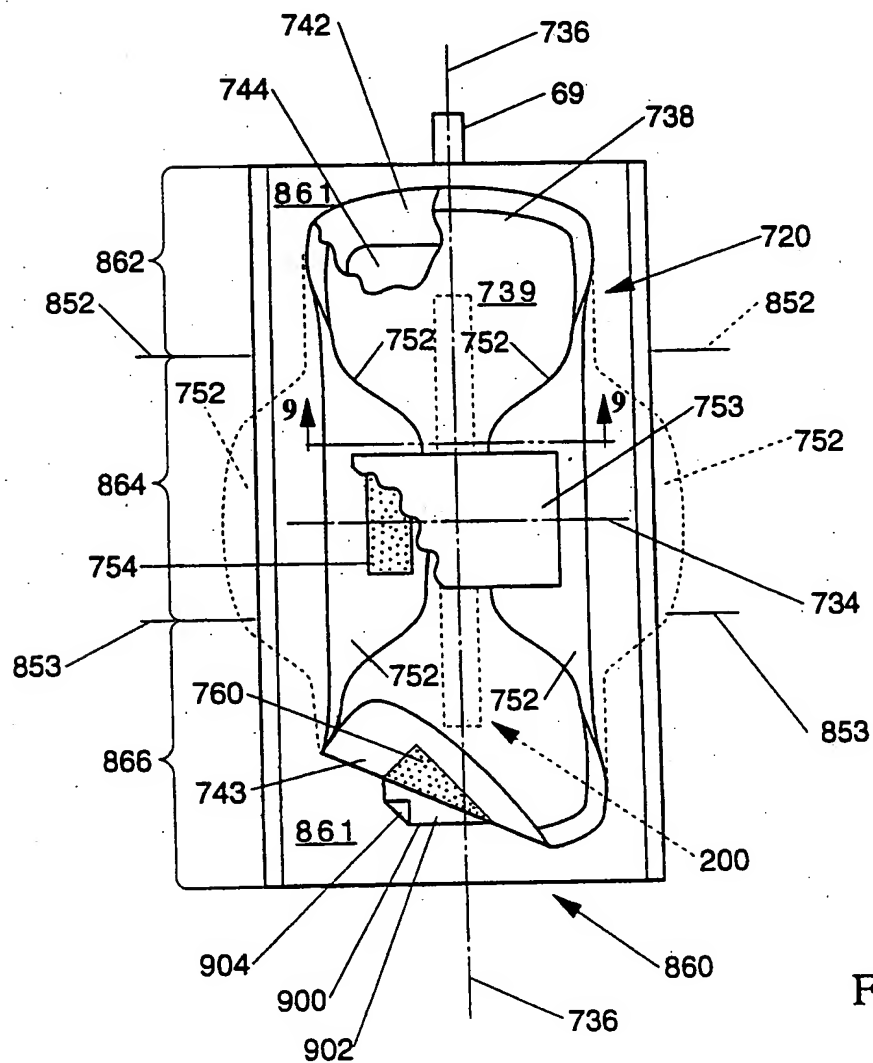


Fig. 8

4/4

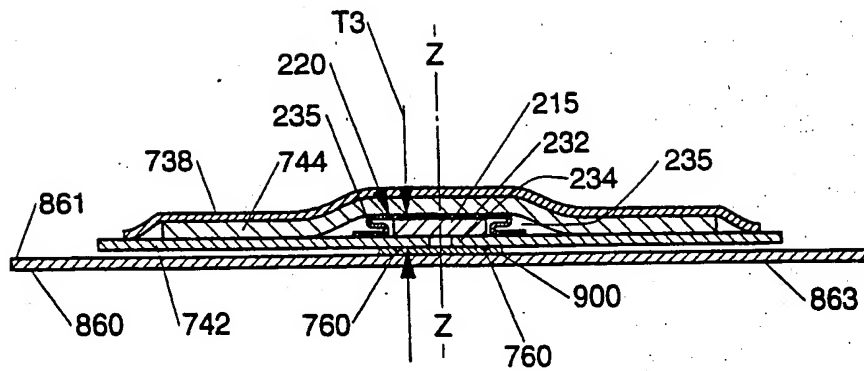


Fig. 9

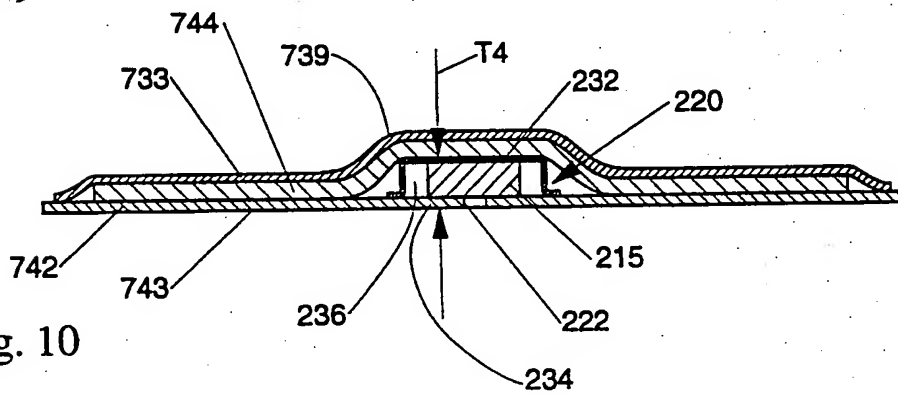


Fig. 10

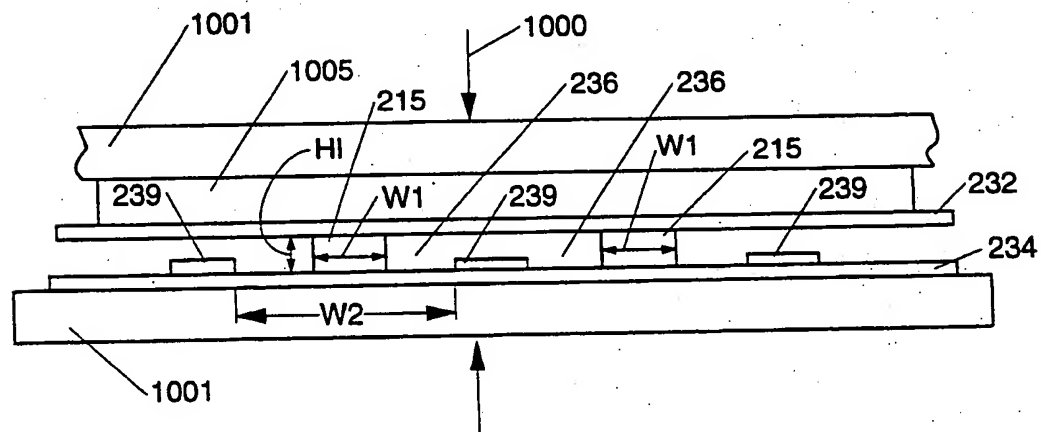


Fig. 11



# INTERNATIONAL SEARCH REPORT

Int. Application No  
PCT/US 95/05478

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 A61F13/15

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO,A,92 07535 (THE PROCTER & GAMBLE COMPANY) 14 May 1992 see claims; figures ---	1
A	US,A,5 306 266 (FREELAND) 26 April 1994 see claims; figures -----	1,3,4, 8-10

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*&\* document member of the same patent family

Date of the actual completion of the international search

21 September 1995

Date of mailing of the international search report

03. 10. 95

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+ 31-70) 340-3016

Authorized officer

Douskas, K

# INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter nal Application No  
PCT/US 95/05478

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A-9207535	14-05-92	AT-T- 115390	15-12-94
		AU-B- 645379	13-01-94
		AU-A- 8929891	26-05-92
		CA-A- 2093350	30-04-92
		CN-A- 1063036	29-07-92
		DE-D- 69105994	26-01-95
		DE-T- 69105994	22-06-95
		EP-A- 0555341	18-08-93
		ES-T- 2065068	01-02-95
		HU-A- 67884	29-05-95
		JP-T- 6502336	17-03-94
		PT-U- 8949	31-05-94
		PT-A- 99364	31-01-94
		US-A- 5324278	28-06-94
US-A-5306266	26-04-94	AU-B- 5870894	19-07-94
		CA-A- 2151910	07-07-94
		CN-A- 1091273	31-08-94
		FI-A- 953050	20-06-95
		NO-A- 952479	21-06-95
		WO-A- 9414394	07-07-94